SR - PHYSICS

Wave motion

1. Two sources A and B are sending notes of frequency 680Hz. A lestener moves from A to B with a constant velocity 'u'. If the speed of sound in air is 340ms^{-1}, what must be the value of 'u' so that he hears 10 beats per second **(Engg-2009)**

1) 2.0 ms^{-1} 2) 2.5 ms^{-1} 3) 3.0 ms^{-1} 4) 3.5 ms^{-1}

2. Two identical piano wire have a fundamental frequency of 600c/s when kept under the same tension. What fractional increase in the tension of one wire will lead to the occurence of 6 beats per second when both wire vibrate simultaneously **(Engg-2009)**

1) 0.01 2) 0.02 3) 0.03 4) 0.04

3. A theatre of volume $100\times40\times10m^3$ can accommodate 1000 visitors. The reverberation time of the theatre when empty is 8.5 sec. If the theatre is now filled with 500 visitors, occupying the front-half seats, the reverberation time changes to 6.2 seconds. The average absorption coefficient of each visitor is nearly **(Med-2009)**

1) 0.6 2) 0.5 3) 0.45 4) 0.7

4. An observer is standing 500 mts away from a vertical hill. Starting from a point between the observer and the hill, a police van moves towards the hill with uniform speed sounding a siren of frequency of 1000 Hz. If the frequency of the sound heard by the observer directly from the siren is 970 Hz, the frequency of the sound heard by the observer after reflection from the hill (Hz) is nearly (Velocity of sound in air = 330 m/s) **(Med-2009)**

1) 1042 2) 1031 3) 1022 4) 1012

5. When a sound wave of wavelength l is propagating in a medium the maximum velocity of the particle is equal to wave velocity. The amplitude of the wave is **(ENG 2008)**

1) l 2) $\frac{l}{2}$ 3) $\frac{l}{2p}$ 4) $\frac{l}{4p}$

6. A car moving with a speed of 72 kmph towards a hill. Car blows horn at a distance of 1800m from the hill. If echo is heard after 10s, the speed of sound (in ms^{-1}) is **(ENG 2008)**

1) 300 2) 320 3) 340 4) 360

7. The frequencies of three tuning forks A,B and C have a relation $n_A > n_B > n_C$. When the forks A and B are sounded together the number of beats produced is n_1. When A and C are sounded together the number of beats produced is n_2, then the number of beats produced when B and C are sounded together is **(MED 2008)**

1) n_1+n_2 2) $\frac{n_1+n_2}{2}$ 3) n_2-n_1 4) n_1-n_2

8. Two strings of the same material and the same area of cross - section are used in sonometer experiment. One is loaded with 12kg and the other with 3kg. The fundamental frequency of the first string is equal to the first overtone of the second string. If the length of the second string is 100cm, then the length of the first string is **(MED 2008)**

1) 300cm 2) 200cm 3) 100cm 4) 50cm

9. A whistle of frequency 540 Hz rotates in a horizontal circle of radius 2m at an angular speed of 15 rad/s. The highest frequency heard by a listener at rest respect to the centre of circle (velocity of sound in air =330 ms^{-1}) **(2007-E)**

1) 590 Hz 2) 594 Hz 3) 598 Hz 4) 602 Hz

10. A segment of wire vibrates with a fundamental frequency of 450 Hz under a tensionof 9 kg weight. Then tension at which the fundamental frequency of the same wire becomes 900 Hz is **(2007-E)**

1) 36 kg-weight 2) 27 kg-weight 3) 18 kg-weight 4) 72 kg-weight

11. A uniform wire of linear density $0.004\,kgm^{-1}$ when stretched between two rigid supports with a tension $3.6\times10^{2}N$, resonates with a frequency of 420Hz. The next harmonic frequency with which the wire resonates is 490Hz. The length of the wire in metres is **(MED 2007)**
1) 1.41 2) 2.14 3) 2.41 4) 3.14

12. To increase the frequency by 20%, the tension in the string vibrating on a sonometer has to be increased by **(MED 2007)**
1) 44% 2) 33% 3) 22% 4) 11%

13. Two strings A and B of lengths, L_A=80 cm and $L_B = x$ cm respectively are used separately in a sonometer . The ratio of their densities (d_A/d_B) =0.81. .The diameter of B is one-half that of A If the strings have the same tension tension and fundamental frequency the value of x is **(2006-E)**
1) 33 2) 102 3) 144 4) 130

14. An observer is standing 500 m away from a vertical hill. Starting between the observer and the hill, a police van sounding a siren of frequency 1000 Hz moves from the siren is 970 Hz , the frequency of the sound heard directly from the siren is 970 Hz , the frequency of the sound heard after reflection from the hill(in Hz) is about ,(velocity of sound =330 ms^{-1}) **(2006-E)**
1) 1042 2)1032 3) 1022 4)1012

15. The two surfaces of a biconvex lens has same radii of curvatures . This lens is made of glass odf refractive index 1.5 and has a focal length 10 cm in air .The lens is cut into equal halves along a plane perpendicular to its principal axis to yield two plano –convex lenses . The two pieces are glued such that the conve surfaces touch each other . If this combination lens is immersed in water (refractive index=4/3 focal length (in cm) is **(2006-E)**
1) 5 2) 10 3) 20 4) 40

16. The frequency of a tuning fork is 256Hz. The velocity of sound in air is $344ms^{-1}$. The distance travelled (in metres) by the sound during the time in which the tuning fork completes 32 vibrations is: **(MED 2006)**
1) 21 2) 43 3) 86 4) 129

17. A uniform string of length 1.5m has two successive harmonics of frequencies 70Hz and 84Hz. The speed of the wave in the string $\left(in\ ms^{-1}\right)$ is : **(MED 2006)**
1) 84 2) 42 3) 21 4) 10.5

Ray optics

18. Four light sources produce the following four waves **(Engg-2009)**
i) $y_1 = a\sin\left(wt + f_1\right)$ ii) $y_2 = a\sin 2wt$
iii) $y_3 = a^{'}\sin\left(wt + f_2\right)$ iv) $y_4 = a^{'}\sin\left(3wt + f\right)$
Superposition of which two waves give rise to interference
1) i and ii 2) ii and iii 3) i and iii 4) iii and iv

19. The two lenses of an achromatic doublet should have **(Engg-2009)**
1) equal powers 2) equal dispersive power
3) equal ratio of their power and dispersive power
4) sum of the products of their power and dispersive power should be equal to zero

20. The light beams produce interference pattern to give maxima an minima on the screen. If the intensities of the light beams in the ratio of 9 : 4, then the ratio of intensities of maxima an minima is **(Med-2009)**
1) 3 : 2 2) 5 : 1 3) 25 : 1 4) 9 : 1

21. A glass slab of thickness 8 cms contains the same number of waves as 10cms long path of water when both are traversed by the same monochromatic light. If the refractive index of water is $\frac{4}{3}$, the refractive index of glass is **(Med-2009)**
1) $\frac{5}{3}$ 2) $\frac{5}{4}$ 3) $\frac{16}{15}$ 4) $\frac{3}{2}$

22. An achromatic combination of lenses produces **(2008E)**
1) images in black and white
2) Coloured images
3) images unaffected by variation of refractive index with wavelength
4) highly enlarged images are formed

23. Statement (S) : Using Huygen's eye piece measurements can be taken but are not correct
Reason (R) : The cross wires, scale and final image are not magnified proportionately because the image of the object is magnified by two lenses, whereas the cross wire scale is magnified by one lens only. **(2008E)**
1) Both (S) and (R) are true, (R) explains (S)
2) Both (S) and (R) are true, (R) cannot explains (S)
3) Only (S) is correct, but (R) is wrong
4) Both (S) and (R) are wrong

24. Wave theory cannot explain the phenomena of **(2008M)**
A) Polarization B) Diffraction
C) Compton effect D) Photoelectric effect
1) A and B 2) B and D 3) C and D 4) D and A

25. In Huygen's eye piece **(2008M)**
1) Chromatic aberration is not eliminated
2) Spherical aberration is completely eliminated
3) Focal length of field lens and eye lens are equal
4) Cross wires cannot be provided

26. Solar spectrum is an example of **(2008M)**
1) line emission spectrum 2) band absorption spectrum
3) line absorption spectrum 4) continuous emission spectrum

27. Match the following **(2007-E)**

List-I	**List-2**
a) Burning candle	e) line spectrum
b) Sodium vapour	f) continuous spectrum
c) Bunsen flame	g) band spectrum
d) Dark lines in solar spectrum	h) absorption spectrum

1) a - g, b - e, c - f, d - h 2) a -g, b -f, c -e, d -h
3) a-f, b-g, c-e, d-h 4) a-f, b -e, c-g, d-h

28. The refractive index of the material of a double convex lens is 1.5 and its focal length is 5cm. If the radii of curvature are equal, the value of the radius of curvature (in cms) is **(2007-E)**
1) 5.0 2) 6.5 3) 8.0 4) 9.5

29. In Ramsden eye piece, the two plano convex lenses each of focal length f and separated by a distance 12 cm. The equivalent focal length (in cm) of the eye piece is **(2007-E)**
1) 10.5 2) 12.0 3) 13.5 4) 15.5

30. In Huygens eye piece **(2007-E)**
1) the cross wires are outside the eye piece
2) condition for achromatism is satisfied
3) condition for minimum spherical aberration is not satisfied
4) the image formed by the objective is a virtual image.

31. In Ramsden eyepiece, the focal length of each lens is F'. The distance of the image formed by the objective lens from the eye lens is
(2007M)
1) $\frac{14F}{15}$ 2) $\frac{13F}{14}$ 3) $\frac{12F}{13}$ 4) $\frac{11F}{12}$

32. The velocities of light in two different media are $2\times10^8 ms^{-1}$ and $2.5\times10^8 ms^{-1}$ respectively. The critical angle for these media is **(2007M)**

1) $\sin^{-1}(1/5)$ 2) $\sin^{-1}(4/5)$

3) $\sin^{-1}(1/2)$ 4) $\sin^{-1}(1/4)$

33. The R.I. of a diverging meniscus lens is 1.5 and its radii of curvature are 3cm and 4 cm. The position of the image, if an object is placed 12 cm infront of the lens is **(2007M)**

1) + 8 cm 2) - 8cm 3) + 9 cm 4) - 9 cm

34 Dispersive power depends on th following **(2006-E)**

1) material of the prism 2) shape of the prism

3) size of the prism 4) size shape and material of the prism

35. Match the appropriate pairs from list I and II **(2006-E)**

List I	**List II**
a) Nitrogen molecules	e) continuous spectrum
b) Incandescent solids	f) Absorption spectrum
c) Fraunhofer lines	h) Emission spectrunm

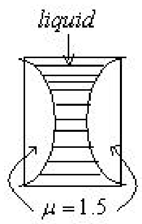
1) a-g; b-e; c-f; d-h 2) a-f; b-e; c-h; d-g 3) a-h; b-e; c-f;d-g 4) a-e; b-g; c-h; d-f

36. A light ray is travelling between two media as given below. The angle of incidence on the boundary in all the cases is 30^0. Identify the sequence of increasing order of angles of refraction. **(2006M)**

a) Air to water b) Water to glass c) Glass to water

1) a,b,c 2) b,c,a 3) c,a,b 4) a,c,b

37. The effective focal length of the lens combination shown in the figure is $-60cm$. The radii of curvature of the curved surfaces of the plano comvex lenses are 12 cm each and refractive index of the material of the lens is 1.5. The refractive index of the liquid is: **(2006M)**



1) 1.33 2) 1.42 3) 1.53 4) 1.60

Physical optics

38. In the Young's double slit expeiment, the intensities at two points P_1 and P_2 on the screen are respectivly I_1 and I_2. If P_1 is located at the centre of a bright fringe and P_2 is located at a distance equal to a quater of fringe width from P_1 the I_1/I_2 is **(Engg-2009)**

1) 2 2) 1/2 3) 4 4) 16

39. In Young;s double slit experiment, the 10th maximum of wavelenght l_1 is at a distance of y_1 from the central maximum. When the wavelength of the source is changed to l_2, 5th maximum is at a distance of y_2 from its central maximum. The ratio $\left(\frac{y_1}{y_2}\right)$ is **(Engg-2009)**

1) $\frac{2l_1}{l_2}$ 2) $\frac{2l_2}{l_1}$ 3) $\frac{l_1}{2l_2}$ 4) $\frac{l_2}{2l_1}$

40. The critical angle of a transparent crystal is 45^0. Then its polarizing angle is **(Med-2009)**

1) $q = \tan^{-1}\left(\sqrt{2}\right)$ 2) $q = \sin^{-1}\left(\sqrt{2}\right)$ 3) $q = \cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$ 4) $q = \cot^{-1}\left(\sqrt{2}\right)$

41. In Fraunhoffer diffraction experiment, L is the distance between screen and the obstacle,b is the size of obstacle and l is wavelength of incident light.The general condition for the applicability of Fraunhoffer diffraction is **(2008 E)**

1) $\frac{b^2}{Ll} >> 1$ 2) $\frac{b^2}{Ll} = 1$ 3) $\frac{b^2}{Ll} << 1$ 4) $\frac{b^2}{Ll} \neq 1$

42. The source is at some distance from an obstacle.Distance between obstacle and the point of observation is ‘b’ and wavelength of light is ‘ l ’. The distance of n^{th} Fresnel Zone from the point of observation is **(2007 M)**

1) $\frac{bnl}{2}$ 2) $b - \frac{nl}{2}$ 3) $b + \frac{nl}{2}$ 4) $b - nl$

43. In young’s double slit experiment using two identical slits,the intensity at a bright fringe on the screen is I. If one of the slits is now closed the intensity of the same bright fringe on the screen will be **(2008 M)**

1) I 2) I/2 3) I/4 4) $\frac{I}{\sqrt{2}}$

44. In Young’s double slit experiment , first has width four times the width of the second slit. The ratio of the maximum intensity to the minimum intensity in the interference fringe system is **(2006-E)**

1) 2:1 2) 4:1 3) 9:1 4) 8:1

Magnetism

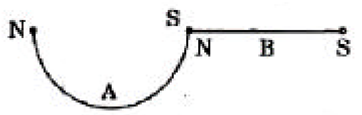
45. Two bar magnets A, B are placed one over the other and are allowed to vibrate in a vibration magnetometer. They make 20 oscillations per minute when the similar poles of A nd B ae on the same side, while they make 15 oscillations per minute when their opposite poles lie on the same side. If M_A and M_B are the magnetic moments of A and B and if $M_A > M_B$, the ratio of M_A and M_B is **(Engg-2009)**

1) 4 : 3 2) 25 : 7 3) 7 : 5 4) 25 : 16

46. A bar magnet of 10cm long is kept with its notth (N) pole pointing North. A neutral point is formed at a distance 15cm from each pole. Give the horizontal component of earth’s field is 0.4 Gauss, the pole strength of the magnet is **(Engg-2009)**

1) 9 amp-m 2) 6.75 amp-m 3) 27 amp-m 4) 13.5 amp-m

47. A magnet of lenght L and moment M is cut into two halves (A and B) perpendicular to its axis. One piece A is bent into a semicircle of radius R and is joined to the other piece at the poles as shown in the figure below. **(Med-2009)**



1) $\frac{M}{2p}$ 2) $\frac{M}{p}$ 3) $\frac{M(2+p)}{2p}$ 4) $\frac{Mp}{2+p}$

48. A magnetised wire of magnet moment M and lenght L is bent in the form of a semi circle ‘r’. Then its magnetic moment is **(2008 E)**

1. $\frac{2M}{p}$ 2. 2M 3. $\frac{M}{p}$ 4. Zero

49. With a standard rectangular bar magnet, the time period of a vibration magneto meter is 4 sec. The bar magnet is cut parallel to its length into 4 equal pieces. The time period of vibration magnetometer when the piece is used (in sec) (bar magnet breadth is small) **(2008E)**

1. 16 2. 8 3. 4 4. 2

50. A short bar magnet placed at a certain distance from D.M.M in tan A position produces a deflection of 60^0. The magnet is now cut into 3 equal pieces. If one piece is kept at same distance in tanA from D.M.M, then the deflection produced is **(2008M)**

1. 10^0 2. 20^0 3. 30 4. 60

51. Two bar magnets are placed in a V.M.M and allowed to vibrate. They make 20 oscillations /minute when their similar poles are on the same side and they make 15 oscillations per minute with their opposite poles lie on the same side. the ratio of their moments **(2008M)**

1. 7**:**25 2. 25**:**7 3. 16**:**9 4. 5**:**4

52. A bar-magnet of moment of inertia $49\times10^{-2} kg\ m^2$ vibrates in a magnetic field of induction 0.5×10^{-4} Tesla. The time period of vibration is 8.8 sec. The magnetic moment of the bar magnet is **(2007-E)**

1) $350 Am^2$ 2) $490 Am^2$ 3) $3300 Am^2$ 4) $5000 Am^2$

53. A bar magnet of magnetic moment M and moment of inertia I is freely suspended such that the magnetic axial line is in the direction of magnetic meridian. If the magnet is displaced by a very small angle (q), the angular acceleration is (Magnetic induction of earth's horizontal field = B_H) **(2007-E)**

1) $\frac{MB_H q}{I}$ 2) $\frac{IB_H q}{M}$ 3) $\frac{Mq}{IB_H}$ 4) $\frac{Iq}{MB_H}$

54. A bar magnet of magetic moment M_1 is axially cut into two equal parts. If these two pieces are arranged perpendicular to each other, the resultant magnetic moment is M_2, then the value of $\frac{M_1}{M_2}$ is **(2007M)**

1. $\frac{1}{2\sqrt{2}}$ 2. 1 3. $\frac{1}{\sqrt{2}}$ 4. $\sqrt{2}$

55. A bar magnet suspended freely ina uniform magnetic field is vibrating with a time period of 3 seconds. If the field strength is increased to 4 times of the earlies field strength, the time period will be (in seconds) **(2007M)**

1. 12 2. 6 3. 1.5 4. 0.75

56. The effect due to uniform magnetic field on a freely suspended magnetic needle is as follows **(2006-E)**

1) both torque and net force are present 2) torque is present but no net fore
3) both torque and net force are absent 4) net force is present but no torque

57. Two short magnets AB and CD are in the X-Y plane and are parallel to X-axis and the coordinates of their centres respectively are (0,2) and (2,0) Line joining the North-South poles of CD is opposite to that of AB and CD at a points P (2,2) is
100×10^{-7} T. When the poles of the magnet CD are reversed , the resultant field induction is
50×10^{-7} T. The values of magnetic moments of AB and CD (in Am^2) are : **(2006-E)**

1) 300 ; 200 2) 600 ; 400 3) 200 ; 100 4) 300 ; 150

58. Two short bar magnets P and Q are arranged such that their contres are on the X-axis and are seperated by a large distance. The magnetic axes of P and Q are along X and Y axes respectively. At a point R, midway between their centres, if B is the magnitude of induction due to Q, the magnetude of total induction at R due to the both magnets is **(2006M)**

1. 3B 2. $\sqrt{5}$B 3. $\frac{\sqrt{5}}{2}$B 4. B

59. The magnetic induction at a distance 'd' from the magnetic pole of the unkown strength 'm' is B. If an identical pole is now placed at a distance of 2d from the first pole, the force between the two poles is **(2006M)**

1. mB 2. $\frac{mB}{2}$ 3. $\frac{mB}{4}$ 4. 2mB

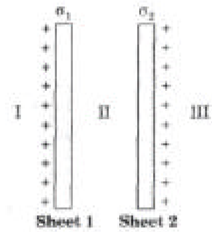
60. An infinitely long thin stright wire has uniform linear charge density of $\frac{1}{3} colu.m^{-1}$. Then the magnitude of the magnitude of the electric intensity at a point 18cm away is (given $\in_0 = 8.8\times10^{-12} C^2/N-m^2$) **(Engg-2009)**

1) $0.33\times10^{11} NC^{-1}$ 2) $3\times10^{11} NC^{-1}$ 3) $0.66\times10^{11} NC^{-1}$ 4) $1.32\times10^{11} NC^{-1}$

61. Two point charges -q and +q are located at points (0, 0, -a) and (0, 0, a) respectively. The electric potential at a point at a point (0, 0, z), where z > a is **(Engg-2009)**

1) $\frac{qa}{4p \in_0 z^2}$ 2) $\frac{q}{4p \in_0 a}$ 3) $\frac{2qa}{4p \in_0 \left(z^2 - a^2\right)}$ 4) $\frac{2qa}{4p \in_0 \left(z^2 + a^2\right)}$

62. Two parallel plane sheets 1 and 2 carry uniform chare densities s_1 and s_2, as shown in the figure. The magnitude of the resultant electric field in the region marked I is $\left(s_1 > s_2\right)$ **(Med-2009)**



1) $\frac{s_1}{2\in_0}$ 2) $\frac{s_2}{2\in_0}$ 3) $\frac{s_1 + s_2}{2\in_0}$ 4) $\frac{s_1 - s_2}{2\in_0}$

63. A parallel plate capacitor with air as dielectric is charged to a potential 'V' using a battery. Removing the battery, the charged capacitor is then connected across an identical uncharged parallel plate capacitor filled with wax of dielectric constant 'k'. The common potential of both the capacitors is **(Med-2009)**

1) V volts 2) *k*V volts 3) (*k* + 1) V volts 4) $\frac{V}{k+1}$ volts

64. A $8mF$ capacitor is charged by a 400 V supply through 0.1 $0.1M\Omega$ resistance. The time taken by the capacitor to develop a potential difference of 300V is (Given $\log_{10}4 = 0.602$) **(Med-2009)**

1) 2.2 sec 2) 1.1 sec 3) 0.55 sec 4) 0.48 sec

65. Two charges q and -q are kept apart. Then at any point on the perpendicular bisector of line joining the two charges. **(2008E)**

1) the electric field strength is zero 2) the electric potential is zero

3) both electric potential and electric field strength are zero

4) both electric potential and electric field strength are non-zero

66. A charge of $1mC$ is divided into two parts such that their charges are in the ratio of 2 : 3. These two charges are kept at a distance 1m apart in vaccum. Them, the electric force between them (in newton) is **(2008E)**

1) 0.216 2) 0.00216 3) 0.0216 4) 2.16

67. A charge q is placed at the centre of the line joining two equal charges Q. The system of three charges will be in equilibrium if q is equal to **(2008M)**

1) $-\frac{Q}{2}$ 2) $-\frac{Q}{4}$ 3) $+\frac{Q}{4}$ 4) $\frac{Q}{2}$

68. A charge ‘Q’ is placed at each corner of a cube of side ‘a’. The potential at the centre of the cube is **(2008 M)**

1) $\frac{8Q}{pe_0 a}$ 2) $\frac{4Q}{4pe_0 a}$ 3) $\frac{4Q}{\sqrt{3}pe_0 a}$ 4) $\frac{2Q}{pe_0 a}$

69. Along the x-axis, three charges $\frac{q}{2}, -q$ and $\frac{q}{2}$ are placed at x = 0, x =a and x =2a respectively. The resultant electric potential at a point ‘P’ located at a distance r from the charge -q $(a << r)$ is ($\in_0$ is the permittivity of free space) **(2007-E)**

1) $\frac{qa}{4p \in_0 r^2}$ 2) $\frac{qa^2}{4p \in_0 r^3}$ 3) $\frac{q\left(\frac{a^2}{4}\right)}{4p \in_0 r^3}$ 4) $\frac{q}{4p \in_0 r}$

70. Two unit negative charges are placed on a straight line. A positive charge q is placed exactly at the mid point between these unit charges. If the system of these three charges is in equilibrium, the value of q (in C) is **(2007-E)**

1) 1.0 2) 0.75 3) 0.5 4) 0.25

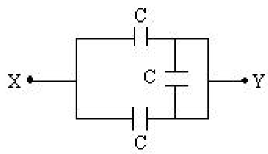
71. The bob of a simple pendulum is hanging vertically down from a fixed identical bob by means of a string of length l If both bobs are changed with a change ‘q ‘ each , time period of the pendulum is (ignore the radii of the bobs) **(2006-E)**

1) $2p\sqrt{\frac{l}{g+_-\left(\frac{q^2}{l^2 m}\right)}}$ 2) $2p\sqrt{\frac{l}{g-\left(\frac{q^2}{l^2 m}\right)}}$ 3) $2p\sqrt{\frac{l}{g}}$ 4) $2p\sqrt{\frac{l}{g-\left(\frac{q^2}{l^2 m}\right)}}$

72. Three charges $1mC$, $1mC$ and $2mC$ are kept at the vertices A, B and C of an equilateral triangle ABC of 10cm side, respectively. The resultant force on the charge at C is **(2007M)**

1) 0.9 N 2) 1.8 N 3) 2.72 N 4) 3.12 N

73. The equivalent capacity between the points X and Y in the circuit with $C = 1mF$ **(2007M)**



1) $2mF$ 2) $3mF$ 3) $1mF$ 4) $0.5mF$

74. Along the X-axis, three charges $\frac{q}{2}$,-q and $\frac{q}{2}$ are placed at x -0, x =a and x =2a respectively . The resultant electric potential at x =a+r(if a ,<<r) is ($\in_0$ is the permittivity of free space : **(2006-E)**

1) $\frac{qa}{4p \in_0 r^2}$ 2) $\frac{qa^2}{4p \in_0 r^3}$ 3) $\frac{q(a^2/4)}{4p \in_0 r^3}$ 4) $\frac{q}{4p \in_0 r}$

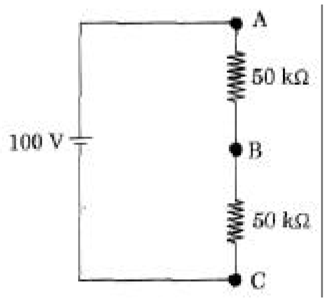
75. The electrical potential on the surface of a sphere of radius ‘r’ due to a charge $3\times10^{-6}C$ is 500V. The intensity of electric field on the surface of the sphere is $\left[\frac{1}{4pe_0} = 9\times10^9 Nm^2C^{-2}\right]\left(inNC^{-1}\right)$

(2006M)

1) 25/27 2) 27/25 3) 25 4) 27

Current electricity

76. In the circuit shown below, a voltmeter of internal resistance R, when connected across B and C reads $\frac{100}{3}$ volts. Neglecting the internal resistance of the battery, the value of R is **(Engg-2009)**



1) $100k\Omega$ 2) $75k\Omega$ 3) $50k\Omega$ 4) $25k\Omega$

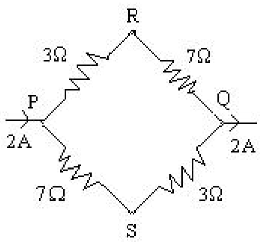
77. A cell in secondary circuit gives null deflectio for 2.5m length of potentiometer having 10m length of wire. If the length of th epotentiometer wire is increased by 1 m without changing the cell in the primary, the position of the null point now is **(Engg-2009)**

1) 3.5 m 2) 3 m 3) 2.75 m 4) 2.0 m

78. A flash light lamp is marked 3.5V and 0.28 A. The filament temperature is 425^0C. The filament resistance at 0^0C is 4Ω. Then, the temperature coefficient of resistance of the material of the filament is **(Med-2009)**

1) $8.5\times10^{-3}/K$ 2) $3.5\times10^{-3}/K$ 3) $0.5\times10^{-3}/K$ 4) $5\times10^{-3}/K$

79. A current of 2 A flows in an electric cicuit as shown in figure. The potential difference $(V_R - V_S)\,m$ in volts (V_R and V_S are potentials at R and S respectively) is **(2008 E)**

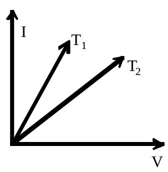


1) – 4 (2) + 2 (3) + 4 (4) - 2

80. When a battery connected across a resistor of $16\,\Omega$, the voltage across the resistor is 12 V. When the same battery is conneted across a resistor of $10\,\Omega$, voltage across it is 11 V. The internal resistance of the battery in Ojms is **(2008 E)**

(1) $\frac{10}{7}$ (2) $\frac{20}{7}$ (3) $\frac{25}{7}$ (4) $\frac{30}{7}$

81. I and V are respectively the current and voltage in a metal wire of resistance 'R'. Two I-V graphs at two different temperatures T_1 and T_2 are given in the graph. Then **(2008 M)**



(1) $T_1 = T_2$ (2) $T_1 > T_2$ (3) $T_1 < T_2$ (4) $T_1 = 2T_2$

82. A projector lamp can be used at a maximum voltage of 60 V, its resistance is 20 Ω, the series resistance (in ohms) required to operate the lamp from a 75 V supply is **(2008 M)**

(1) 2 (2) 3 (3) 4 (4) 5

83. Two unknown resistrance X and Y are connected to left and right gaps of a meter bridge and the balancing point is obtained at 80 cm from left. When a 10Ω resistance is connected in parallel to X, the balancing point is 50 cm from left. The values of X and Y respectively are **(2007 E)**

(1) 40Ω, 9Ω (2) 30Ω, 7.5Ω (3) 20Ω, 6Ω (4) $10\ \Omega$, 3Ω

84. The current in a circuit containing a battery connected to $2\ \Omega$ resistance is 0.9 A. When a resistance of $7\ \Omega$ connected to the same battery, the current observed in the circuit is 0.3A. Then the internal resistance of the battery is **(2007 E)**

(1) $0.1\ \Omega$ (2) $0.5\ \Omega$ (3) $1\ \Omega$ (4) Zero

85. Twelve cells, each having e.m.f 'E' volts are connected in series and are kept in a closed box. Some of these cells are wrongly connected with positive and negative terminals reversed. This 12 cell battery is connected in series with an ammeter, an external resistance 'R' ohms and a two-cell battery (two cells of the same type used earlier, connected perfectly in series). The current in the circuit when the 12-cell battery and 2-cell battery aid each other. Then the number of cells in 12-cells battery that are connected wrongly is **(2006 E)**

1) 4 2) 3 3) 2 4) 1

86. One end each of a resistance 'r' capacitance C and resistance '2r' are connected together. The other ends are respectively connected to the positive terminals of the batteries P, Q, R having respectively e.m.f s E, E and 2E. The negative terminals of the batteries are then connected together. In this circuit, with steady current the potential drop across the capacitance is : **(2006 E)**

1) $\frac{E}{3}$ 2) $\frac{E}{2}$ 3) $\frac{2E}{3}$ 4) E

87. A teacher asked a student to connect 'N' cells each of e.m.f. 'e' in series to get a total e.m.f. of Ne. While connecting, the student, by mistake, reversed the polarity of 'n' cells. The total e.m.f. of the resulting series combination is : **(2006 M)**

1) $e\left(N-\frac{n}{2}\right)$ 2) $e(N-n)$ 3) $e(N-2n)$ 4) eN

Thermo electricity

88. The thermo-emf (E) of a certain thermocouple is found to vary with temperature t (in ^{0}C) in accordance with the relation

$$E = 40t - \frac{t^2}{20}$$

where t is the temperature of the hot junction, the cold junction being kept at 0^0C. The neutral temperature of the couple is **(Med-2009)**

1) 100^0C 2) 200^0C 3) 300^0C 4) 400^0C

89. A copper constantan thermocouple prodcues an e.m.f. of $40\,mV$ per ^oC. The smallest temperature difference that can be measured with this thermocouple is 2.5 ^oC, when a galvanometer capable of detecting as low as 10^{-6} amp. is employed. The resistance of that galvanometer is **(2008 E)**

1) 50 W 2) 100 W 3) 200W 4) 400W

90. A heater coil working on mains produces 100 calories of heat in a certain time. Now the heater coil is cut into three equal parts and one part is only used for heating. The quantity of heat produced (in calories) in the same time is **(2008 M)**

1) 300 2) 200 3) 100/3 4) 200/3

91. Temperature of cold junction in a thermocouple is 10º C and neutral temperature is 270º C, then the temperature of inversion is **(2007 E)**
1) 540 ºC 2) 530 ºC 3) 280 ºC 4) 260 ºC

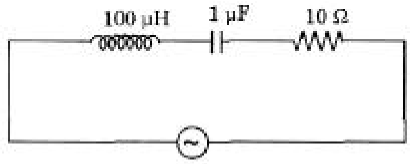
92. In a thermo-couple the cold junction is at 30 ºC. The temperature of inversion is found to be 540 ºC. Then the neutral temperature is **(2007 M)**
1) 270ºC 2) 510ºC 3) 285ºC 4) 240ºC

93. **If the cold junction is held at 0ºC, thermo e.m.f. 'V' of a thermocouple varies as V = 10 ×^{6}10**
$\frac{1}{40}\times 10^{-6}\, t^2,$ where 't is the temperature of the hot junction in ºC. The neutral temperature and the maximum value of thermo e.m.f. are respectively. **(2006 E)**
1) 200ºC; 2 mV 2) 400ºC; 2 mV 3) 100ºC; 1 mV 4) 200ºC; 1 mV

94. Consider the following statements A and B and identify the correct answer :
A : Thermistors can have only negative temperature coefficients of resistances.
B : Thermistors with negative temperature coefficients of resistance are used as resistance thermometers, to measure low temperatures of the order of 10 K. **(2006 M)**
1) Both A and B are true 2) Both A and B are false
3) A is true, but B is false 4) A is false, but B is true

Electro magnetism

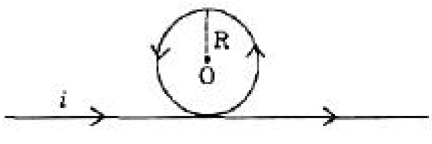
95. The following series L-C-R circuit, when driven by an e.m.f. source of angular frequency 70 kilo-radians per second, the circuit effectively behaves like **(Engg-2009)**



1) purely resistive circuit 2) series R-L circuit
3) series R-C circuit 4) series L-C circuit with R = 0

96. A wire of lenght '*l*' is bent into a circular loop of radius R and carries a current I. The magnetic field at the centre of the loop is 'B'. The same wire is now bent into a double loop of equal radii. If both loops carry the same current I and it is in the same direction, the magnetic field at the centre of the double loop will be **(Engg-2009)**
1) zero 2) 2B 3) 4B 4) 8B

97. An infinitely long straight conductor is bent into the shape as shown below. It carries a current of i Amps and the radius of the circular loop is R metres. Then the magnitude of magnetic induction at the centre of the circular loop is **(Engg-2009)**



1) $\frac{m_0 i}{2pR}$ 2) $\frac{m_0 ni}{2R}$ 3) $\frac{m_0 i}{2pR}(p+1)$ 4) $\frac{m_0 i}{2pR}(p-1)$

98. A charged particle velocity $\bar{u} = x\hat{i} + y\hat{j}$ moves in a magnetic field $\bar{B} = y\hat{i} + x\hat{j}$. Magnitude of the force acting on the particle is F. The correct option for F is **(Med-2009)**
a) No force will act on particle if $x = y$ b) Force will act along y axis if $y < y$
c) Force is proportional to $\left(x^2 - y^2\right)$ if $x > y$ d) Force is proportional to $\left(x^2 + y^2\right)$ if $y > x$
1) a and b are true 2) a and c are true
3) b and d are true 4) c and d are true

99. In a galvanometer 5% of the total current in the circuit passes through it. If the resistance of the galvanometer is G, the shunt resistance 'S' connected to the galvanometer is **(EAM 2008)**

1) 19G 2) G/19 3) 20G 4) G/20

100. A circular coil of wire of radius 'r' has 'n' turns and carries a current 'I'. The magnetic induction (B) at a point on the axis of the coil at a distance $\sqrt{3}$ r from its centre is **(EAMCET 2008 MED)**

1) $\frac{m_0 In}{4r}$ 2) $\frac{m_0 In}{8r}$ 3) $\frac{m_0 nI}{16r}$ 4) $\frac{m_0 In}{32r}$

101. Two wires A and B are of lengths 40 cm and 30 cm. A is bent into a circle of radius r and B into an arc of radius r. A current i_1 is passed through A and i_2 through B. To have the same magnetic inductions at the centre, the ratio of $i_1 : i_2$ is **(2007-E)**

1) 3 : 4 2) 3 : 5 3) 2 : 3 4) 4 : 3

102. The natural frequency of an LC - circuit is 1,25,000 cycles per second. Then the capacitor C is replaced by another with a dielectric medium of dielectric constant k.In this case, the frequency decreases by 25 kHz. The value of k is **(2007-E)**

1) 3.0 2) 2.1 3) 1.56 4) 1.7

103. When a positively charged particle enters a uniform magnetic fild with uniform velocity , it trajectory can be **(2006-E)**

1) a straight line 2) a circle 3) a helix

1) 1 only 2) 1 or 2 3) 1 or 3 4) any one of 1 , 2 and 3

104. A rectangular loop of length l and breadth $'b'$ is placed at a distance of x from an infinitely long wire carrying current i such that the direction of current is parallel to breadth . If the loop moves away from the current wire in a direction perpendicular to it with a velocity 'v' the magnitude of the e.m f in the loop is (m_0 = permeability of free space) **(2006-E)**

1) $\frac{m_0 iv}{2p\,x}\left(\frac{l+b}{B}\right)$ 2) $\frac{m_0 i^2 v}{2p^2 x}\log\left(\frac{b}{l}\right)$ 3) $\frac{m_0 ilbu}{2p\,x(l+x)}$ 4) $\frac{m_0 ilbu}{2p\,x(l+x)}\log\left(\frac{x+1}{x}\right)$

105. A small square loop of wire of side $'l'$ is placed inside a large a square loop of side $'L'$ (L>>l) .If the loops are coplanar and their centres coincide, the mutual induction of the system is directly proportional to **(2006-E)**

1) $\frac{L}{l}$ 2) $\frac{l}{L}$ 3) $\frac{L^2}{l}$ 4) $\frac{l^2}{L}$

106. A long horizontal rigidly supported wire carries a current $i_a = 96A$. Directly above it and parallel to it at a distance, another wire of 0.144N weight per metre carrying a current $i_b = 24A$, in a direction opposite to that air due to magnetic repulsion, then its distance (in mm) from the lower wire is : **(EAMCET 2006 MED)**

1) 9.6 2) 4.8 3) 3.2 4) 1.6

Atomic physics

107. The work function of a certain metal is $3.31\times10^{-19} J$. Then the maximum kinetic energy of photoelectrons emitted by incident radiation of wavelength 5000A^0 is **(Engg-2009)**

1) 2.48eV 2) 0.41eV 3) 2.07eV 4) 0.82eV

108. A photon of energy 'E' ejects a photoelectron from a metal surface whose work functio is W_0. If this electron enters into a uniform magnetic field of induction 'B' in a direction perpendicular to the field and describes a circular path of radius 'r', then the radius 'r' is given by, (in the usual notation) **(Engg-2009)**

1) $\sqrt{\frac{2m(E-W_0)}{eB}}$ 2) $\sqrt{2m(E-W_0)eB}$

3) $\frac{\sqrt{2e(E-W_0)}}{mB}$ 4) $\frac{\sqrt{2m(E-W_0)}}{eB}$

109. Electrons accelerated by a petential of 'V' volts strike a target material to produce 'continous X-rays'. Ratio between the de-Broglie wavelength of the electrons striking the target and the shortest wavelength of the 'continous X-rays' emitted is **(Med-2009)**

1) $\frac{h}{\sqrt{2Vem}}$ 2) $\frac{1}{c}\sqrt{\frac{2m}{Ve}}$ 3) $\frac{1}{c}\sqrt{\frac{Ve}{2m}}$ 4) $\frac{hc}{\sqrt{\frac{Ve}{2m}}}$

110. In Millikan's oil drop experiment, a charged oil drop of mass 3.2×10^{-14} kg is held stationary between two parallel plates 6mm apart, by applying a potential difference of 1200V between them. How many electrons does the oil drop carry? (g = $10ms^{-2}$) **(Med-2009)**

1) 7 2) 8 3) 9 4) 10

111. An X-ray tube produces a continuous spectrum of radiation with its shortest wavelength of $45\times10^{-2}A^0$. The maximum energy photon in the radiation in eV is. (h =6.62×10^{-34}Js, C=3×10^8m/sec.) **[E 2008]**

1) 27,500 2) 22,500 3) 17,500 4) 12,500

112. X-rays of energy 50KeV. are scattered from a carbon target. The scattered rays are at 90^0 from the incident beam. The percentage of change in wavelength (m_e= 9×10^{-31}Kg, C= 3×10^8m/s.) **[E 2008]**

1) 10% 2) 20% 3) 5% 4) 1%

113. The threshold frequency for a certain metal is n_0 when a certain radiation of frequency $2n_0$ incident on this metal surface maximum velocity of photo electrons emitted is 2×10^6m/s, if radiation of frequency $3n_0$ is incident on the same metal surface the maximum velocity of the photo electrons emitted (in m/s) is.**[M 2008]**

1) 2×10^6 2) $2\sqrt{2}\times10^6$ 3) $4\sqrt{2}\times10^6$ 4) $4\sqrt{3}\times10^6$

114. An electron beam travels with a velocity of $1.6\times10^7 ms^{-1}$ perpendicularly to magnetic field of intensity 0.1 T. The radius of the path of the electron beam $\left(m_e=9\times10^{-31}kg\right)$ **(2007-E)**

1) $9\times10^{-5}m$ 2) $9\times10^{-2}m$ 3) $9\times10^{-4}m$ 4) $9\times10^{-3}m$

115. The work function of the nickel is 5 eV. When a light of wavelength $2000A^0$ falls on it, it emits photoelectrons in the circuit. Then the potential difference necessary to stop the fastest electrons emitted is (given $h=6.67\times10^{-34}$ JS) **(2007-E)**

1) 1.0 V 2) 1.75 V 3) 1.25 V 4) 0.75 V

116. In an experiment on photoelectric emission from a metallic surface, wavelength of incident light is 2×10^{-7} m and stopping potential is 2.5 V. The threshold frequency of the metal (in Hz) approximately (charge of electron $e=1.6\times10^{-19}C$, Plank's constant $h=6.6\times10^{-34}$ JS) **(2007-E)**

1) 12×10^{15} 2) 9×10^{15} 3) 9×10^{14} 4) 12×10^{13}

117. A proton and an alpha particle are accelerated through the same potential difference. The ratio of wavelengths associated with proton and alpha particle respectively is **[M 2007]**

1) $1:2\sqrt{2}$ 2) 2:1 3) $2\sqrt{2}:1$ 4) 4:1

118. A oil drop having a mass 4.8×10^{-18} C stands still between two changed horizontal plates separated by a distance of 1 cm If now the polarity of the plates is changed , instantaneous acceleration of the drop is (in ms $^{-2}$): **(2006-E)**
1) 5 2) 10 3) 20 4) 40

119. A proton, a deuteron (nucleus of H^2) and an a -particle with same kinetic energy enter a region of uniform magnetic fild moving at right angles to the filed . The ratio of the radii of their circular paths is **(2006-E)**
1) 1:2:4 2) 1: $\sqrt{2}$:1 3) 2$\sqrt{2}$:1 4) 1:1:2

120. In X-ray spectrum, transition of an electron from an outer shell to an inner shell gives a characteristics X-ray spectral line. If we consider the spectral lines K_b , L_b and M_a , then**[M 2006]**
1) K_b and L_b have a common inner shell
2) K_b and L_b have a common outer shell
3) L_b and M_a have a common outer shell
4) L_b and M_a have a common inner shell

121. The de-broglie wavelength of an electron and the wavelength of a photon are same. The ratio between the energy of the photon and the momentum of the electron is **[M 2006]**
1) h 2) c 3) 1/h 4) 1/c

Nuclear physics

122. The radioactivity of a sample is 'X' at a time 't_1' and 'Y' at a time 't_2' . If the mean life time of the specimen is 't ', the number of atoms that have disintegrated in the time interval $\left(t_1 - t_2\right)$ is **(Engg-2009)**
1) $Xt_1 - Yt_2$ 2) $X - Y$ 3) $\frac{X-Y}{t}$ 4) $\left(X - Y\right)t$

123. Atomic mass of $^{13}_{6}C$ is 13.00335 amu and its mass number is 13.0. If 1 amu = 931 MeV, binding energy of the neutrons present in the nucleus is **(Med-2009)**
1) 0.24 MeV 2) 1.44 MeV 3) 1.68 MeV 4) 3.12 MeV

124. Let F_{pp},F_{pn} and F_{nn} denote the magnitudes of the nuclear force by a proton on a proton ,by a proton on a neutron and by a neutron on a neutron respectively when the separation is less than one fermi, then **(2008 E)**
1) $F_{pp}>F_{pn}=F_{nn}$ 2) $F_{pp}=F_{pn}=F_{nn}$ 3) $F_{pp}>F_{pn}>F_{nn}$ 4) $F_{pp}<F_{pn}=F_{nn}$

125. The following particles are Baryons: **(M-2008)**
1) Nucleons and hyperons 2) Nucleons and leptons
3) Hyperons and leptons 4) Hyperons and Bosons

126. In Sun, the important source of energy is **(2007-E)**
1) proton -proton cycle 2) carbon - nitrogen cycle
3) carbon - carbon cycle 4) nitrogen - nitrogen cycle

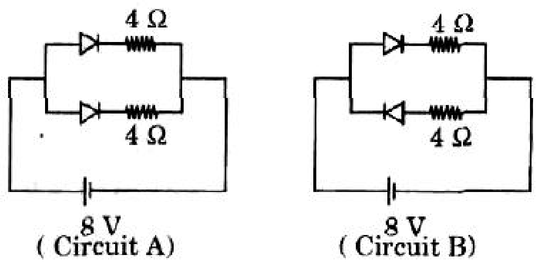
127. Electron belongs to the following class of elementary particles **[2007M]**
1) Hardon 2) Lepton 3) Boson 4) Baryon

128. A free netron decays spontaneously into **(2006-E)**
1) a proton, an electron and anti-netrino 2) a proton , an electron and a neutrino
3) a proton and electron 4) a proton , an electron , a neutrino and anti-neutrino

129. Assertion(A): Nuclear forces arise from strong Coulombic interactions between protons and neutrons.
Reason (R): Nuclear forces are independent of the charge of the nucleons.
[2006M]
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true but R is the not correct explanation of A
3) A is true, but R is false 4) A is false, but R is true

Semi conductor device

130. Currents flowing in each of the following circuits A and B respectively are **(Engg-2009)**



1) 1A, 2A 2) 2A, 1A 3) 4A, 2A 4) 2A, 4A

131. A full-wave $p-n$ diode rectifier uses a load resistor of 1500Ω. No filter is used. The forward bias resistance of the diode is 10Ω. The efficiency of the rectifier is **(Med-2009)**
1) 81.2% 2) 40.6% 3) 80.4% 4) 40.2%

132. Among the following one statement is not correct when a junction diode is in forward bias (**ENG-2008**)
1) the width of depletion region decreases
2) free electron on n- side will move towards the junction
3) holes on p -side move towards the junction
4) electron on n- side and holes on p-side will move away from junction

133. If an intrinsic semiconductor is heated , the ratio of free electrons to holes is
(MEDI-2008)
1) greater than one 2) less than one
3) equal to one 4) dercease and becomes zero

134. In an n-type semiconductor, the fermi energy level lies **(2007-E)**
1) in the forbidden energy gap nearer to the conduction band
2) in the forbidden energy gap nearer to the valence band.
3) in the middle of forbidden energy gap
4) outside the forbidden energy gap

135. In a transistor circuit the base current changes from 30 mA to 90 mA. If the current gain of the transistor is 30, the change in the collector current is **(MED- 2007)**
1) 4 mA 2) 2 m A 3) 3.6 mA 4) 1.8 mA

136. Consider a p-n junction as a capacitor , formed with p and n –materials acting as thin metal electrodes and depletion layer transistor is working as an amplifier in CE configuration .If C_1 and C_2 are the base-emitter and collector emitter junction capacitances, then : **(2006-E)**
1) $C_1 > C_2$ 2) $C_1 < C_2$ 3) $C_1 < C_2$ 4) $C_1 < C_2 = 0$

137. Ap-n-p transistor is said to be in active region of operation, When : **(MED-2006)**
1) Both emitter junction and collector junction a are forward biased
2) Both emitter junction and collector junction are reverse biased
3) Emitter junction is forward biased and collector junction is reverse biased
4) Emitter junction is reverse biased and collector junction is forward biased